A STRATEGY FORMULATION PROCESS FOR THE DELIVERY OF TECHNOLOGY ENABLED SERVICE DELIVERY SYSTEMS

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ABSTRACT

The Product Service Systems, *servitization*, and Service Science literature continues to grow as organisations seek to protect and improve their competitive position. The potential of technology applications to deliver service delivery systems facilitated by the ability to make real time decisions based upon '*in the field'* performance is also significant. Research identifies four key questions to be addressed. Namely: how far along the *servitization* continuum should the organisation go in a single strategic step? Does the organisation have the structure and infrastructure to support this transition? What level of condition monitoring should it employ? Is the product positioned correctly in the value chain to adopt condition monitoring technology?

Strategy consists of three dimensions, namely content, context, and process. The literature relating to PSS, *servitization*, and strategy all discuss the concepts relative to content and context but none offer a process to deliver an aligned strategy to deliver a service delivery system enabled by condition based management. This paper presents a tested iterative strategy formulation methodology which is the result of a structured development programme.

KEYWORDS: Service delivery system, servitization, strategy, condition based maintenance

1 INTRODUCTION

The mantras that are lean and six sigma are no longer enough when seeking to protect and expand the organisation's competitive space. Typically such initiatives are reductionist in nature with companies seeking to focus on core competencies thus reducing waste and cost. With the impact of global markets and the emergence of competition from low cost economies coupled with the drive for sustainability one sees Product Service Systems [1] [2] [3] [4], servitization [5] [6] [7] [8], and service science [9] [10] evolve. These approaches offer a paradigm shift in the business models employed by organisations who seek to establish 'whole life' added value by offering various levels of service in support of their manufactured products. The literature offers many examples of servitization of such organisations as companies move from the traditional make and sell contract offering base level services (equipment and spares), through intermediate levels of service, to complex service delivery systems (figure 1) [11] [12].

As organisations adopt intermediate level services one sees the emergence of condition monitoring in support of the product. Whilst the use of such sensor technology is applied to the product, its use at this level is predominantly for monitoring rather than management of the product but does facilitate product oriented PSS business models [3]. Finally advanced services include integrated support agreements, advanced rental and leasing solutions, and the facilitation of availability contracting all provided by technology enabled service delivery systems [12].

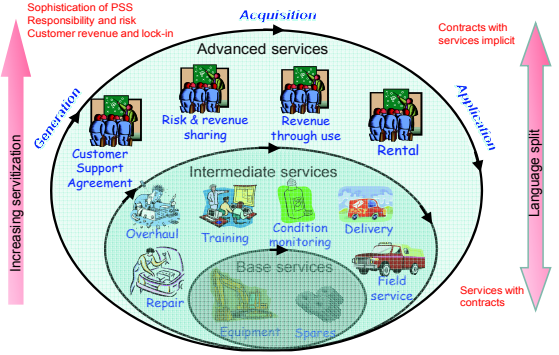

Figure 1: Increasing levels of servitization [11]

When reviewing the literature relative to PSS, servitization, Condition Based Monitoring (CBM) [13] [14], and Integrated Vehicle Health Management (IVHM) [15] [16] one sees that in order to offer a service delivery system enabled by sensor lead technology there needs to be alignment between the level of servitization undertaken [3], the organizational structure and the impact on vertical integration [7], the level of sensor integration and system architecture [17] [18], and consideration of the products ability to accept such applications and its relative position in the value chain [12].

The fulfillment of these requirements is dependent upon the effectiveness of the operations strategy followed by the organisation. Gaps identified within the literature [12] which are concurred by a survey of UK manufacturers [19] identify the need for a strategy formulation process which enables either a planned strategy to be developed or an emergent strategy defined. Such a strategy seeks to align these parameters to the needs of the stakeholders and the ability of the organisation and product to support. This paper introduces a strategy formulation process which has been tested and found to be feasible, usable, and useful [20].

2 RESEARCH METHODOLOGY

The identification of the gaps within the literature and the reported needs of the practitioner informed the research aim:

> "*To understand the landscape relative to condition based management of products whilst in use within the field and identify potentially high value enabled applications and operations. To deliver a strategy formulation methodology which seeks to target such applications to deliver an aligned service delivery system".*

This section of the paper presents the research approach, the development process employed, and the means of testing the pre-pilot, pilot, and final strategy formulation process.

2.1. The research programme and development of the methodology

The research programme consists of five phases. The first phase involves gaining an understanding of the landscape and issues relative to Condition Based Monitoring and the Condition Based Management of manufactured products whilst in use, with particular focus upon Integrated Vehicle Health Management (IVHM). This entailed a review of the literature which identified specific gaps to be addressed [12]. These gaps were also identified when analysing data returned from a survey of UK manufacturers who produced complex products [21] and who indicated that they were, or were planning to support their products using CBM/IVHM techniques.

The second phase of the research required an improved understanding of the concepts supporting a service delivery system together with documented strategies that may exist to deliver them. This phase identified that strategy consists of three dimensions, namely content, context, and process. Whilst the literature offers a plethora of contributions that deal with content and context, there are very few that deal with the process of strategy formulation and none that dealt with the process in the context of this research.

The third phase adopts an existing methodology [22] as a pre-pilot methodology and applies this to an on-going case study within a UK manufacturer producing sound equipment. The existing methodology was observed and audited during its implementation and areas for development were documented. The task was to ascertain if this pre-pilot methodology would lead its users to consider servitization (and PSS) as alternative solutions to the traditional reductionist responses of 'lean', six sigma, and other moves to core competences. From these observations a requirements document and subsequent specification for the methodology was generated for the next stage, the pilot methodology.

Phase four focuses on the primary evaluation of the pilot methodology using multiple case studies which through serial iteration enables the refinement of the emergent specification. The final phase of the research programme seeks to validate the methodology through additional case studies and present the final methodology.

2.2. Testing of the methodology

After a review of the literature relating to the strategy formation process and the subsequent testing and assessment of such processes this research assesses the derived methodology against three key parameters, namely usability, feasibility, and usefulness. This assessment adopts and applies the guidance of Platts et al [20] when selecting these criteria and applies them to a series of case studies that were undertaken at the three development stages of the methodology (Figure 2). By following the iterative development and testing process illustrated in figure 2, and employing such research methods as structured interviews, observations, and practitioner opinions and recommendations obtained during company visits and workshops, the final methodology is developed and defined.

3.0. Description of the tested methodology.

The methodology is presented by way of 3 part work book which can be used by practitioners (with or without the aid of a facilitator) seeking to formulate their operating strategy. Part 1 of the work book introduces the reader to the concepts of PSS, servitization, and operations strategy with part 2 presenting an overview of the methodology. The final part of the work book presents signposted detail of the methodology with worked examples to guide the user in its application.

The application of the methodology seeks to identify the actual operating strategy being applied and the gaps in alignment to stakeholder requirements. Whilst not offering prescriptive solutions to the

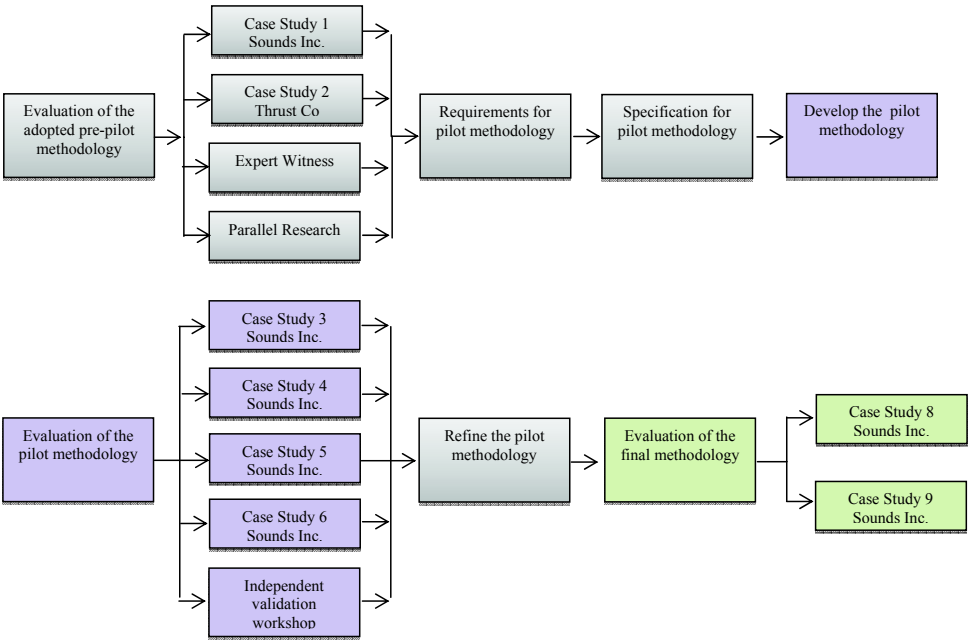

Figure 2: The development and testing process for the methodology

operating strategy question the methodology allows for a structured and iterative gap analysis to be conducted which facilitates the formation or emergence of alternative operating strategies one of which is competing through condition based management enabled service delivery systems. The use of the 'service temple' is adopted to guide the user through the process of applying the methodology and developing the final strategy (figure 3).

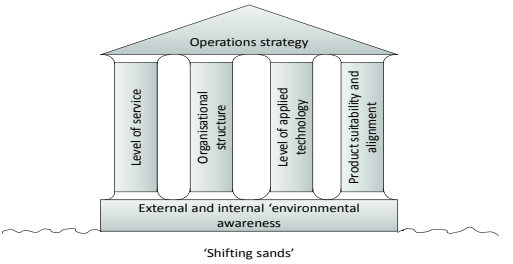

Figure 3: The 'Strategy Temple'

It is seen that the structure comprises seven elements which if assembled correctly will deliver an operations strategy which is aligned to stakeholder needs, whilst possessing the best suited organisational structure and level of technology inbuilt to the product and support system. It also allows for a test to see is the product is suitable for such an initiative finally delivering a strategy which if followed will deliver an operations strategy which facilitates competitive advantage through the adoption of enhanced service delivery systems [12].

The shifting sands that the structure sits upon denotes the changing environment. Various tools and techniques including surveys and structured interviews are applied to both internal and external stakeholders in order to appraise and understand these 'sands' (*the needs of the stakeholder*) and recognition is made that these are in fact dynamic. By the application of a structured but iterative gap analysis the foundation (*the external and internal environmental awareness*) is laid.

The research recognizes that the formulation of an aligned strategy is in fact a product development exercise. That is strategy is the result of critical and thinking. For this reason the methodology looks to the product development tools, and in particular the 'House of Quality' (HOQ) development tool as one which offers sufficient rigor, structure, repeatability, and auditability when seeking to formulate such a strategy. Whilst not innovative today the use within the strategy and operations management arenas is. The four pillars represent the four iterations of the HOQ method. The four houses applied within the process are the service house, the technology house, the technology house, and the product suitability house. The aim, rationale, and outcome for the application of each house is listed in table 1 with an overview of the application of each house illustrated in figure 4.

Whilst there is insufficient space within the size parameters of this paper to describe in full the complete process as illustrated in figure four, a description of the first house (*the service house*) as identified in figure 5 is presented. The laying of the 'foundation' and the construction of the 'service pillar' builds on the pre-pilot stratagem methodology previously published by the author [22] [23].

In laying the foundation for the '*service temple'* an understanding of the following was achieved through the use various data acquisition tools (observation, questionnaire, structured interviews…etc):

- The definition and scope of the area organisation under study (Corporate, SBU, department etc),
- The definition and scope of the operations and offerings under review,
- The environment in which the organisation operates and the change inhibitors/drivers that prevail,

- How the organisation really achieves competitive status,
- How the competitive status may be improved giving due consideration to all alternatives (servitization).

Redding et al (2010) describe the processes undertaken in laying the 'foundation' of the 'service temple' within their paper previously presented at ICMR2010. The output of these processes are a list of improvement initiatives which are then entered into the service house (Box A – Figure 5). These initiatives are then assigned an importance rating as identified from the data returned from the stakeholders (Box B). Typically a multi-disciplinary team identifies the organisation's offerings which can, or could serve to satisfy these requirements in the service house (Box C – Figure 5). It will be noted in the example (figure 5) that these offerings represent the offerings as illustrated in figure 1, namely base, intermediate, and advanced services.

Table 1: **Aim, rationale and outcome for each phase of the methodology** [12]

	House of Service (The Service Pillar)	The Organisational House (The Organisation Pillar)	The Technology House (The Technology Pillar)	The Product House (The Product Pillar)
Aim Service strategy	To understand which forces and drivers are acting upon the organisation, and align the operations strategy to these forces.	To understand the optimum organisational structure required to deliver the service expectation within the service house	To understand the level of technology to adopt in order to support the organisation to deliver the required level of service as identified within the service house.	To assess the manufactured offering for suitability and purpose to deliver data by way of '*intelligent*' product.
Rationale Technology strategy	The need for an holistic methodology which identifies threats to the organisation and aligns operations strategy to that threat (considering initiatives other than cost or lean)	There needs to be alignment between the service expectation and the organisational structure in order to deliver the service offering	As the company moves through the service continuum, greater knowledge of the product's performance in the field is required	Not all products are suited to the application of IVHM type technology. It may be necessary to increase the product offering in the value chain.
Outcomes Product strategy	To set service targets and levels to be offered by the company to align with customer, market, stakeholder expectations	To align the organisational requirements of the business with the service expectations.	To align the technology requirements by way of 'intelligent' product to that of the organisational requirements and service expectations	Assessment of the product's suitability to be fitted with required technology and to what level to deliver the desired 'in field' data.

The multi-disciplinary team then seeks to rank the correlation between the initiatives listed in box 'A' and the offerings that are listed in box 'C'. For example, when reviewing the correlation between 'equipment' and 'Greater understanding of customer needs' it is observed that the team recorded a correlation index of '2', that being of medium importance. The team then discusses the correlation between each pair of parameters and enters an index score from 0-3 (see key- figure 5). Upon completion of the correlation index the team can then complete the final stage in completing the service house by calculating the service targets. This is achieved by applying the following formula:

$$\text{Service Target (T)} = \sum\sum_{i=1}^{n}(Rt \times Wt)$$

Where: R_i = Importance Ranking…… (Box B)
W_i = Correlation index (Weighting)…… (Box D)

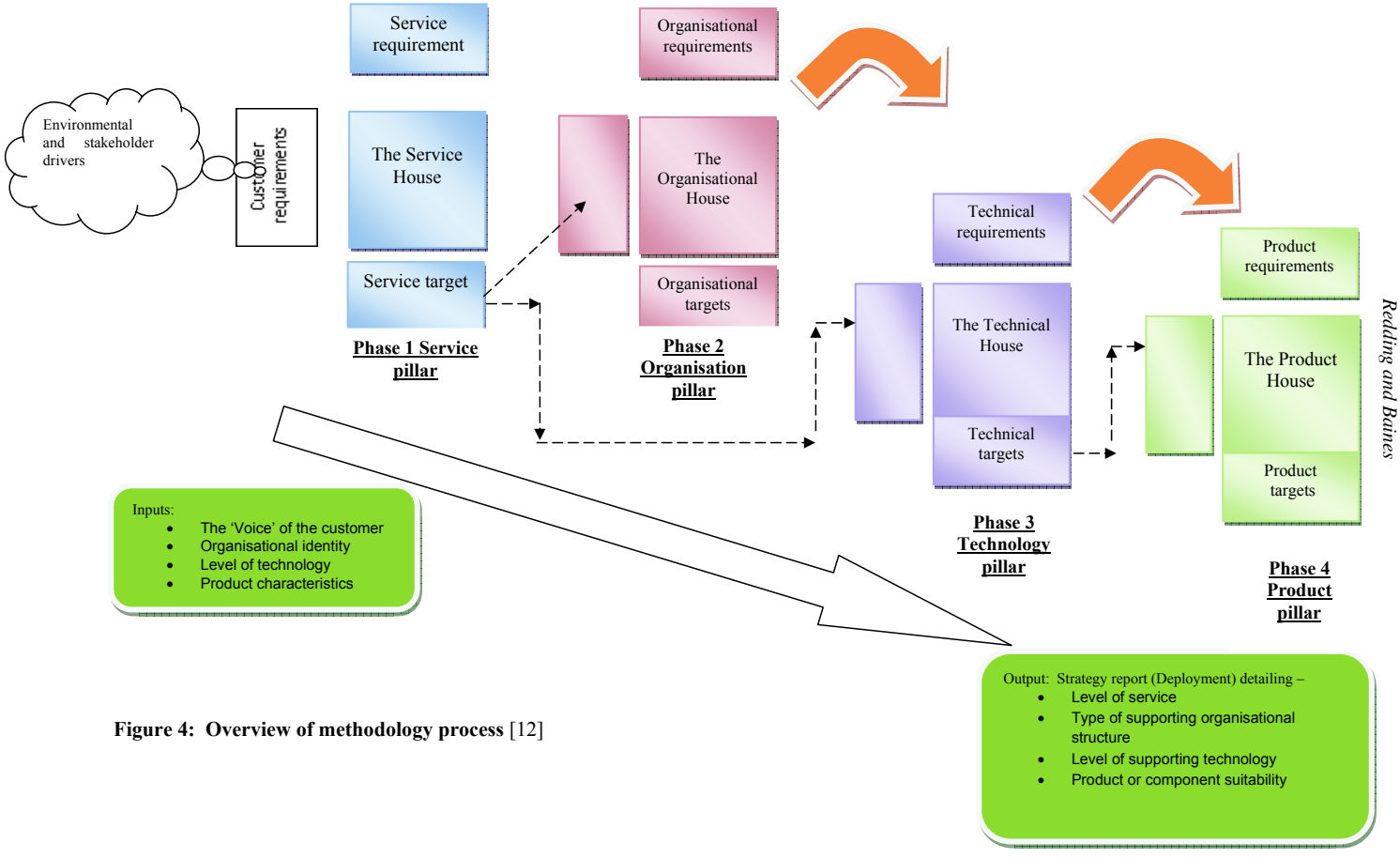

Figure 4: Overview of methodology process [12]

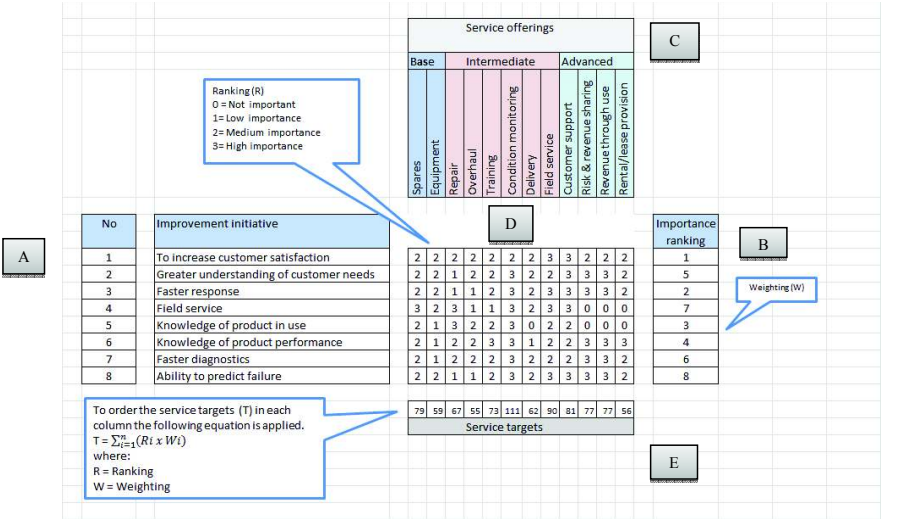

Figure 5: The completed service house [12]

This results in a set of service targets which are entered into Box 'E'. These data present a ranked list of service targets which are aligned to the needs of the customer (stakeholders) and the level of service that the organisation can, or has the potential top offer. Thus the service pillar of the temple is constructed and the service targets are then entered into the following house within the sequence. Full and illustrated details of the process with examples are found in Redding (2012). The final phase of the process having constructed each pillar is the presentation of the final operations strategy (the temple roof). In disseminating and communicating the final developed operations strategy which is fully aligned to the needs of the customer, the organisation's ability to provide a level of service, the operational structure and infrastructure of the organisation, the level of CBM technology to apply, and the suitability or the product to be supported by such technology, the methodology uses the policy deployment matrix as a means to present and monitor the strategy (Figure 6).

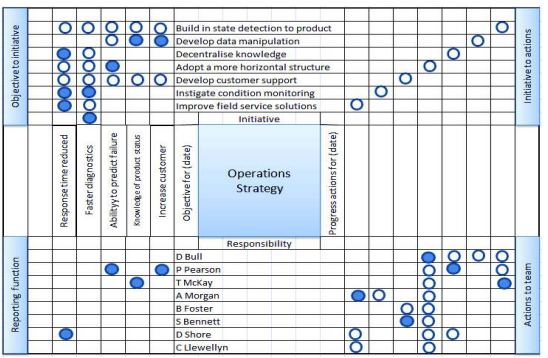

Figure 6: Completed policy deployment matrix [12]

4. CONCLUSIONS

This paper reports recent research relating to the development of a strategy formulation process for the delivery of a technology enabled service delivery system. The requirement for such a process is identified as a gap within the literature relating to Integrated Vehicle Health Management and is verified by a survey of UK based manufacturing organisations producing complex mechanical, electro-mechanical, and/or electronic components and systems. The literature relative to strategy (*as a process*) is reviewed for guidance and an accepted test method selected. An existing pre-pilot methodology is chosen and applied in order to define the requirements of the process and specification to meet the needs of the stakeholders. Namely to develop an operations strategy which aligns the needs of the customer (*level of service*), the organisational structure, the level of technology to adopt to support the product in the field, and to ascertain if the manufactured product holds the correct value added position to deliver a servitized offering to the customer. The process is developed through two design iterations after testing with (and seeking informed opinions from) senior executives with responsibility for strategy development and implementation. The process is assessed for feasibility, usability, and usefulness in each stage of its development. Whilst further testing and development is required, the authors present this methodology as an iterative process which fills a gap in the literature and a need identified by practitioners. It allows for the formation of a defined (or emergent) operations strategy which waymarks the path towards an aligned service delivery system.

ACKNOWLEDGEMENTS

The authors would like to thank the Engineering and Physical Sciences Research Council (EPSRC) for funding this research through the Cranfield Innovative Research Centre (IMRC).

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